Space Weather Technical Forecast

Issued on Wednesday, 01 November 2023 at 01:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: High speed stream continuing to decline. Chance of Active fluence.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low, with a peak of a C6.9 flare from AR3477 at 01/0041 UTC. X-ray flux has however shown a steady increase in background levels since 31/1800 UTC as AR3477 became visible on the far southeastern limb. AR3474 has evolved significantly and now exhibits a weak delta spot in the southeastern extremes of the region, and is now classified as a Dai/βγδ. AR3477 is likely to reveal increased complexity as it rotates onto the visible disc, with the remaining three regions all weak, simple and comparatively inactive. A CME from the eastern side of the Sun is unlikely to be Earth-directed but will be analysed as further imagery becomes available. A filament eruption from the southeast quadrant around 31/2200 UTC will also be analysed when sufficient imagery is available with the potential for an Earth-directed component.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed at L1 continue to decline, as the high speed stream from coronal hole 66 moves towards the western limb, reaching 450 km/s by the end of the period. Density has been below average. Total magnetic field strength, Bt, has been consistently weak, with the north-south component, Bz, also varying weakly. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux started at high levels, with a peak of 1710 pfu at 31/1620 UTC, but has since returned to moderate levels. The associated 24-hour fluence remains below the Active (1e8 integrated pfu) threshold but on generally steady trend, reaching 6.78e7 integrated pfu at 31/2359 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Low solar activity is expected, with a slight chance of Moderate activity, especially from AR3474 and potentially from AR3477.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. The high speed stream from coronal hole 66 is slowly waning, with solar winds expected to approach background levels. Geomagnetic activity is likely to be mostly Quiet to Unsettled.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background. High energy electron flux (greater than 2MeV) is forecast to oscillate between moderate to high levels. Associated 24 electron fluence is expected to see a rising trend, and is expected to reach Active levels (greater than 1e8 integrated pfu) by either 02 or 03 Nov.

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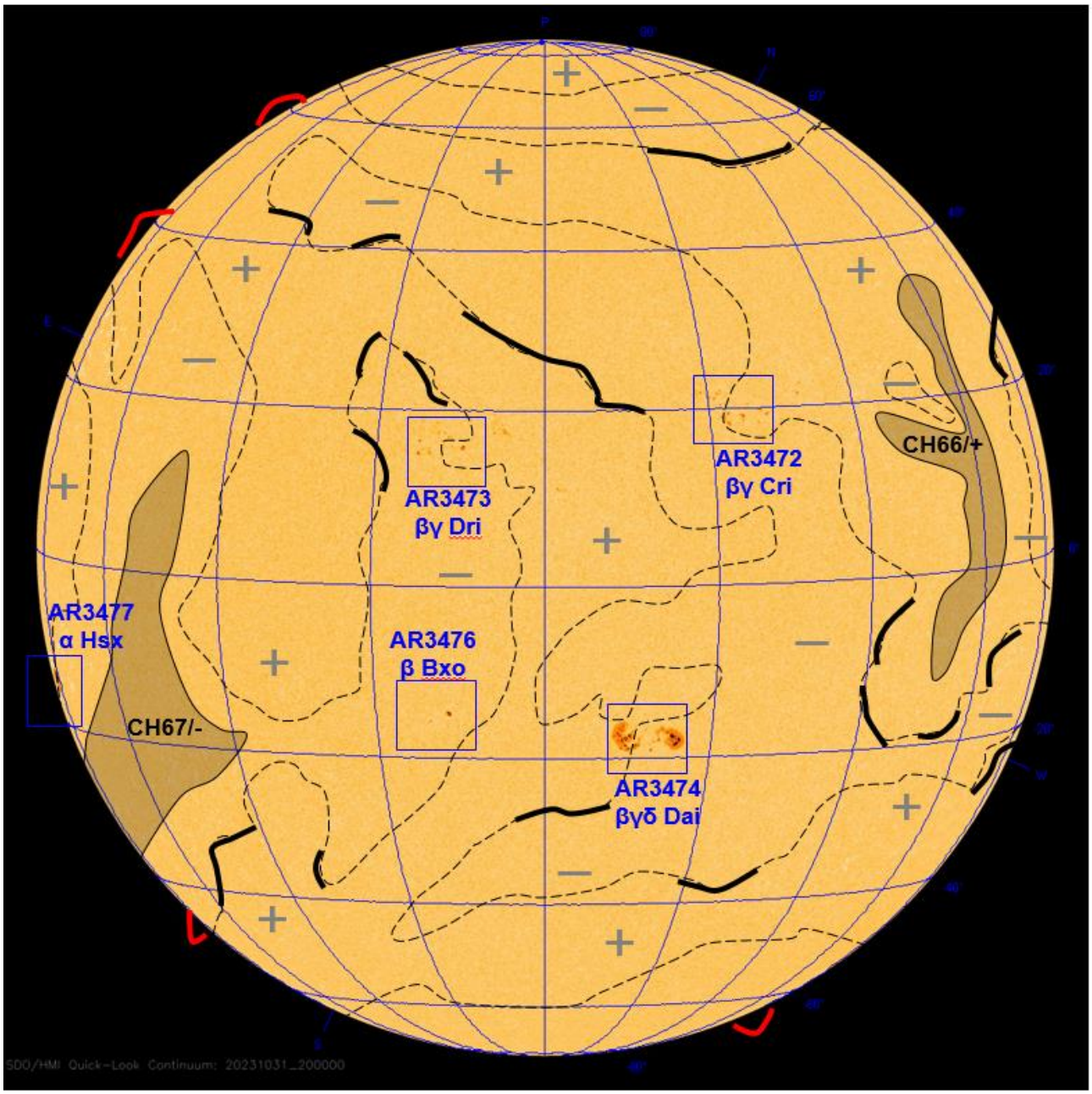
Figure 1. Solar Analysis Valid 31/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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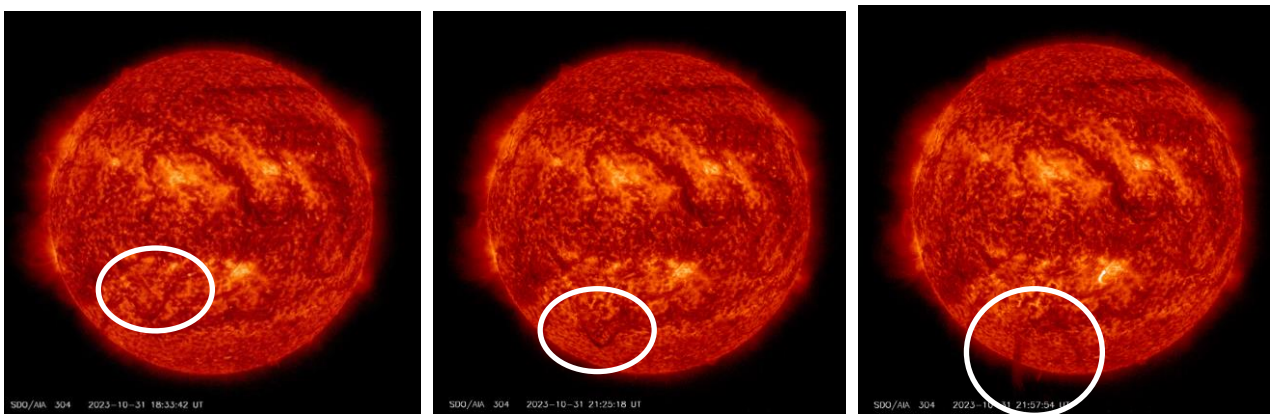
Geomagnetic Storms:
No Earth-directed CMEs are forecast over the next four days. A filament eruption from the southeast quadrant around 31/2200 UTC may have given rise to an Earth-directed CME and relevant imagery will continue to be monitored and analysed as necessary.

Solar wind speeds have declined to between 400-500km/s as the effects of the high speed stream from coronal hole 66 continues to ease. No further coronal holes are forecast to connect with Earth within the forecast period with winds expected to fall to background by 03 Nov. Geomagnetic activity is Quiet to Unsettled, gradually becoming Quiet in the absence of any significant Earth-directed CMEs.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Filament eruption from the southeast quadrant which will be analysed for a potential Earth-directed component



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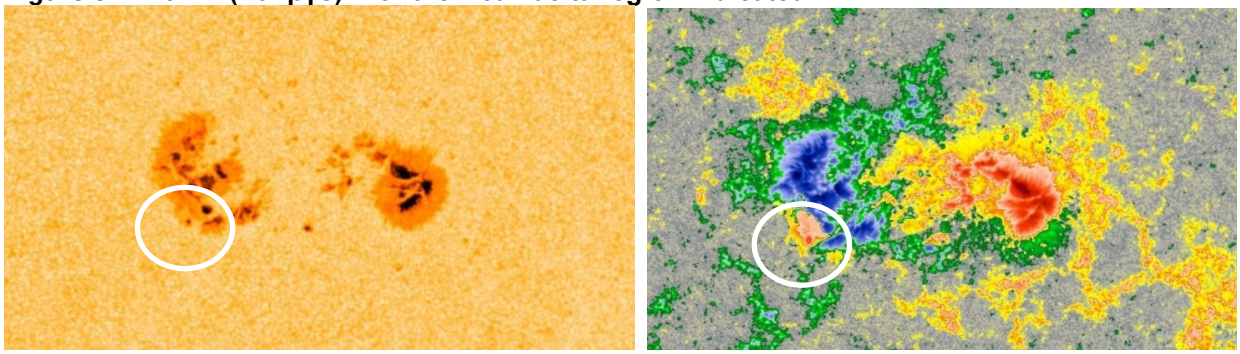
Radio Blackouts - X-Ray Flares:

AR3474 is the largest and most complex region on the visible disc and has recently developed a weak delta spot. The region is also producing regular mid-range C-class flares. Another region of note is AR3477 on the eastern limb, which may reveal increased complexity as it rotates onto the visible side of the Sun. The remaining regions are all relatively simple but continue to be monitored.

Low activity is expected, with an increasing risk of M-class flares, from both AR3474 and AR3477.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: AR3474 (Dai/βγδ) with the weak delta region indicated.



Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels, although there is a very slight risk of proton storms from AR3474 as it increases in complexity and rotates into the western hemisphere of the Sun.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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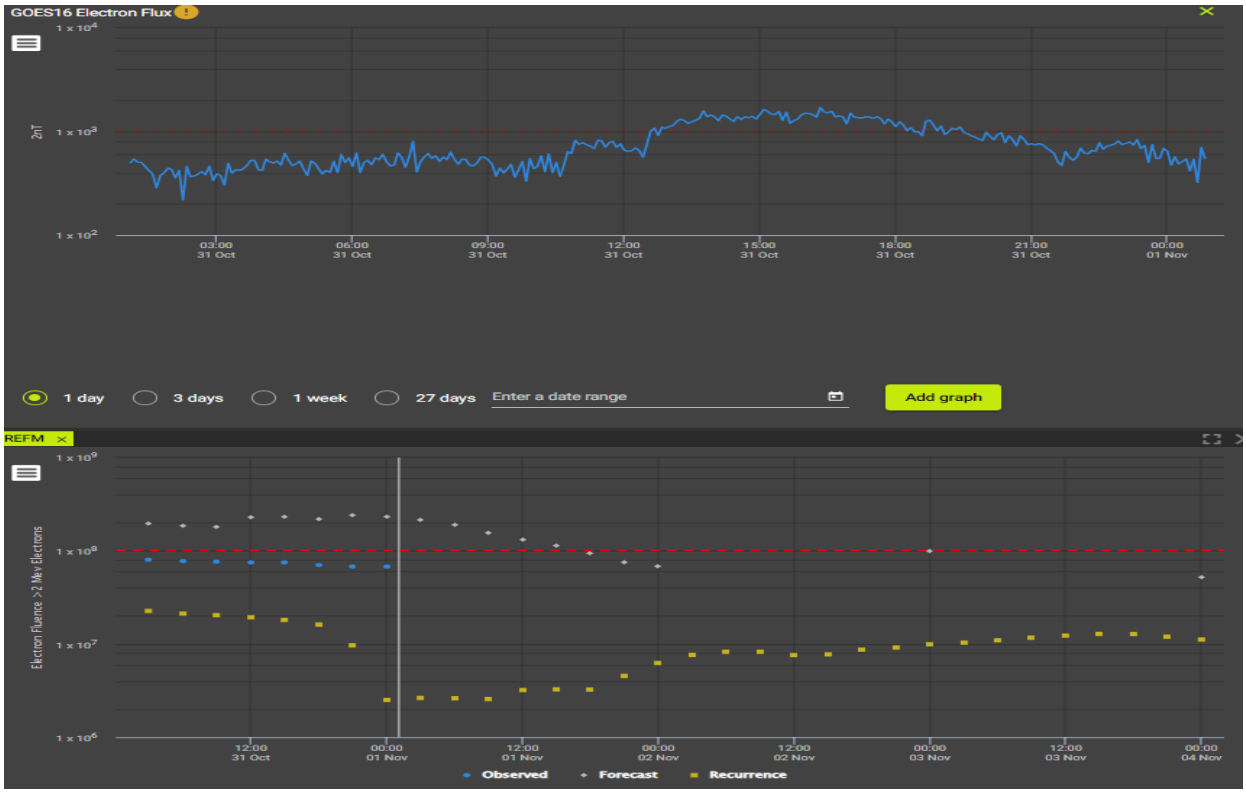
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) is expected to continue to vary between moderate and high levels due to the legacy of the high speed stream from coronal hole 66. This pattern is expected to continue through the period with high generally reaching similar levels each day. As the solar wind speed has eased the outer radiation belt has been able to relax to its natural position close to geosynchronous orbit. This means that GOES 16 is likely to be sampling the highest populated region of the radiation belt.

Electron fluence values have risen towards, but just below, the Active threshold. There is an increased likelihood that electron fluence will rise above the threshold later in the period due to the continued slightly elevated solar winds.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	60	70	80	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: GOES 16 electron flux and REFM electron fluence, showing electron fluence approaching Active threshold.



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